AS COMPUTER SCIENCE H046
MARCH MOCK EXAM
12/03/2025

Computing Principles + Algorithms and Problem Solving

Name: Block

Mark: /115 Percentage:

Grade:

Note: Calculators are not allowed.
Duration of exam: 2 hours
Answer all questions.

Section A - Computer Principles

Answer **all** questions

Q1

A company produces CPUs for desktop and laptop computers. Each CPU is designed around the Von Neumann Architecture.

(a) Describe what is meant by the term 'Von Neumann Architecture'.

[2]

(b) A CPU will repeatedly run the Fetch-Decode-Execute-cycle shown in **Fig. 1**.

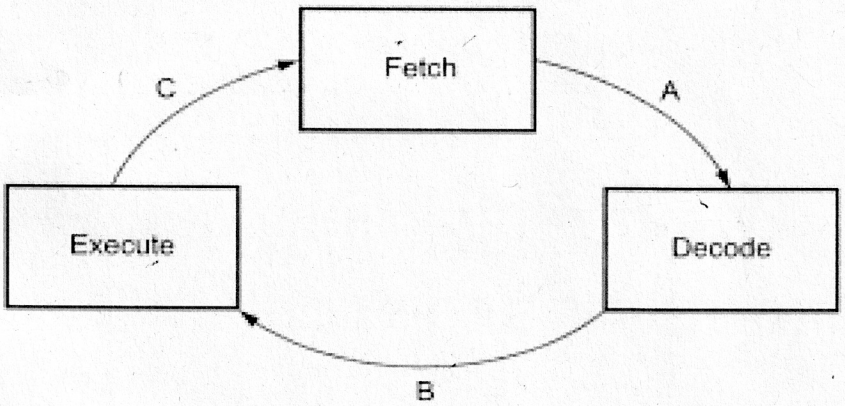


Fig. 1

Describe what happens during the 'Fetch' stage shown in **Fig. 1**.

You should refer to the use of specific registers in your answer.

[4]

Q2

Open source software has grown in popularity over the last few decades.

(a) Explain the difference between open source and closed source software.

[4]

(b) Explain why all closed source software is most likely to be compiled rather than run on an interpreter.

[2]

(c) State the name of a type of translator software other than a compiler or interpreter.

[1]

Q3

Desktop operating systems are an essential part of modern personal computer systems (i.e. desktops and laptops).

(a) Describe how a desktop operating system is loaded when a personal computer is first switched on.

[2]

(b) Operating systems often come with utilities.

State a utility that might be supplied with a desktop operating system to help with system maintenance.

[1]

Q4

Variables in programs contain specific types of data.

(a) Complete the table below to suggest a suitable data type for each piece of data.

Data	Data Type
'H'	Character
"Hello"	
35	
-2.625	Real
True	

[3]

(b) Show the denary number 35 as an 8-bit (unsigned) binary number.

[1]

(c) The character 'A' in the ASCII character set is represented by the denary value 65. Write the binary representation for the ASCII character 'H'. Show your working.

[2]

(d) Show the denary number -2¾ as a floating-point binary number with a 6-bit mantissa and 4-bit exponent, both stored using two's complement representation.

[3]

Q5*

A student, Dan, on a limited budget finds his computer is running slowly. He uses his computer for university work and internet browsing.

Discuss what measures can be taken to improve Dan's computer's performance. You should explain what these measures are, why they improve the performance and justify whether you would recommend them.

[9]

Q6

A cinema offers discounted tickets, but only under one of the following conditions:

- Customer is under 18 and has a student card.
- Customer is over 60 and has ID which proves this.

Let:

A be Customer is under 18

B be Customer has a student card

C be Customer is over 60

D be Customer has ID

Q be Discount ticket issued

(a) Complete the Boolean expression below:

$Q \equiv$

[3]

(b) The cinema has a voucher which promises free popcorn when the voucher is produced whilst buying a soft drink or bottle of water.

Let:

E be Voucher is shown

F be Soft drink is bought

G be Bottle of water is bought

R be Free popcorn given.

This could be written as:

$R \equiv (E \wedge F) \vee (E \wedge G)$

(i) Complete the truth table below.

E	F	G	(E∧F)	(E∧G)	(E∧F)∨(E∧G)
1	1	1			
1	1	0			
1	0	1			
1	0	0			
0	1	1			
0	1	0			
0	0	1			
0	0	0			

[4]

(ii) Simplify the expression

(E∧F) ∨ (E∧G)

[2]

Most films are now distributed to cinemas digitally. A studio allows cinemas to download its latest film 5 days before the release date via a private download. It wants to ensure that no cinema shows it before the release date.

(c) Describe **one** technical measure the studio could use to ensure that films are not shown early.

[2]

Q7

Stacks and queues are both data structures.

(a) State which of a stack or queue would be considered as a 'First In First Out' data structure.

.....[1]

A stack is shown in Fig. 4.1 before a set of operations are carried out on it.

(b) Draw what the stack shown in Fig. 4.1 would look like after the following operations:

```
push("A"), push("B"), pop(), push("C"), pop(), push("D")
```

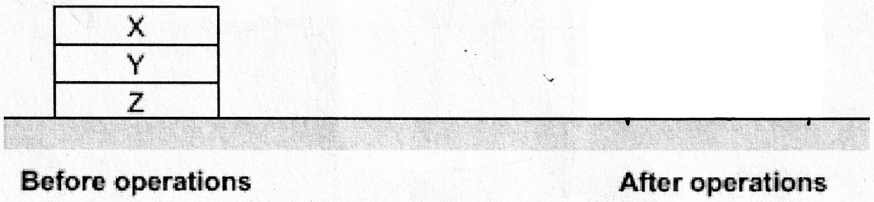


Fig. 4.1

[2]

Fig. 4.2 shows a stack in two states: State One and State Two.

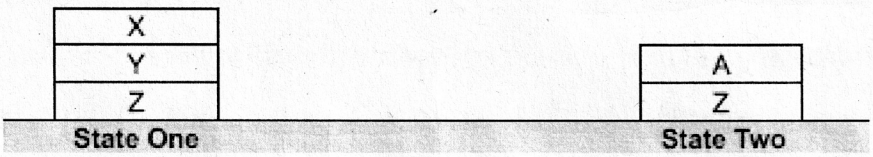


Fig. 4.2

(c) List the operations needed to get the stack from State One to State Two.

[3]

Q8

6

Details of customers sending parcels are stored in a database. The database contains a table called `parcel` and a table called `customer`.

a Draw an entity relationship diagram showing the `parcel` and `customer` tables.

[2]

b To prove parcels have not been damaged in transit, the delivery drivers use a digital camera to take a photograph of them when they arrive at their destination. The digital camera uses flash memory.

(i) Describe **one** advantage of the digital camera using flash storage rather than magnetic.

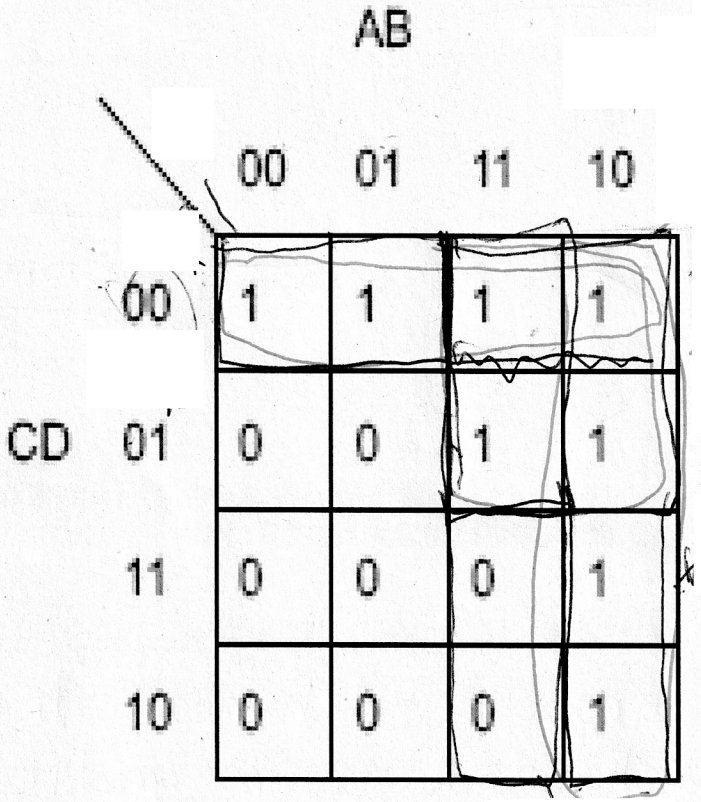
[2]

(ii) Explain whether lossless or lossy compression would be most appropriate to store the photographs. Justify your response.

[3]

Q9

a) Find the Boolean expression represented in the Karnaugh Map below. Show your working.



CD \ AB	00	01	11	10
00	1	1	1	1
01	0	0	1	1
11	0	0	0	1
10	0	0	0	1

Simplified Expression: **[3]**

b) An online shop uses a website to sell its products. Part of the HTML code that is used for a login form on the website is shown here.

```
<p>
    <label>Usernarne:</label>
    <input type="text" id="userNarne">
</p>

<p>
    <label>Password: </label>
    <input type="text" id="Password" onchange="errorCheck()">
</p>

<p>
    <label id="errorText">
</p>
```

The <label> tag will instruct the user what information they need to enter.
The code onchange will run a function called errorCheck automatically after a password has been entered.
The function errorCheck will check that the password is a suitable length.

Write JavaScript code for the function errorCheck which:
• checks the length of the password is between 8 and 12 characters (including 8 and 12)
• displays the message "Password Length Error" in the HTML label tag identified by the id errorText if the length is not between 8 and 12 characters

[5]

Q10

Modern computer systems use networking in order to share hardware, software and data.

Networking uses protocols such as TCP/IP.

(a) State what is meant by the term 'protocol'.

[1]

(b) The protocol TCP/IP uses a 4-layer stack.

Complete the table below to show the 4 layers in the TCP/IP stack.

Layer	Typical features/uses/what happens in the layer
Application	
Link	

[4]

SECTION B – Algorithms and Problem Solving
Answer all questions.

Q11

A procedure takes as input a number between 1 and 100. It calculates and outputs the square of each number starting from 1, to the number input. The square of a number is the result of multiplying a number by itself.

```
procedure squares()
    do
        number = int(input("Enter a number between 1 and 100"))
    until number >= 1 AND number <= 100

    for x = 1 to number
        print(x * x)
    next x
endprocedure
```

(a) The procedure uses one programming construct twice.

State whether the construct that is used twice, is iteration or branching.

[1]

(b) State why the algorithm is a procedure and not a function.

[1]

(c) The procedure needs to be tested.

(i) Describe how black box testing can be used to test a program.

[3]

(ii) For each type of test given in the table, identify **two** examples of test data that can be used to test the program.

Test Type	Test Data 1	Test Data 2
Normal		
Extreme		
Invalid		

[3]

6

Q12

A procedure is shown in the following pseudocode.

The arrays that are passed to the procedure store integer values.

`length` returns the total number of elements the array can hold.

```
01 procedure calculateOnce(data[]:byRef, nextData[]:byRef)
02       if data.length > nextData.length then
03                loopCount = nextData.length - 1
04       else
05                loopCount = Data.length - 1
06       endif
07       count = 0
08       while count <= loopCount
09                data[count] = data[count] + nextData[count]
10                count = count + 1
11       endwhile
12 endprocedure
```

(a) A decision is made on line 02.

(i) Identify the line where the second decision is made.

..... **[1]**

(ii) Explain the purpose of the code in lines 02 to 06.

[3]

(b) The procedure has parameters passed by reference.

(i) Give the identifiers of the **two** parameters.

1

2

[2]

(ii) State the effect of the array `data[]` being passed by reference and not by value.

[1]

(c) The program needs a second procedure, `sortData`. It will be called taking the array `data[]` as a parameter by reference.

The procedure will then perform a bubble sort on the data in the array.

(i) Show each stage of a bubble sort on the following contents of `data[]`:

95	10	5	33	100	77	45

[4]

(ii) Write, using pseudocode, the procedure `sortData`.

[8]

(iii) An alternative sorting method is the insertion sort.

Show how an insertion sort will sort the data in the following array.

95	10	5	33	100	77	45

[4]

Q13

A programmer is designing a program that will store data.

The programmer is deciding whether to store the data in a stack or a queue.

(a) Identify **one** similarity and **one** difference between a stack and a queue.

[2]

(b) The pseudocode function, `enqueue`, inserts an item into a queue.

```
01  function enqueue(item)
02          if tailPointer >= queue.length then
03                return false
04          else
05                queue[tailPointer] = item
06                tailPointer = tailPointer + 1
07                return true
08          endif
09  endfunction
```

(i) Give the name of the parameter in the function `enqueue`.

[1]

(ii) Give the name of **one** global variable that is used in the function `enqueue`.

[1]

(iii) Describe **one** benefit and **one** drawback of using global variables instead of parameter passing in a subroutine.

[4]

(iv) The function `enqueue` can be called by the main program.

Explain why the function `enqueue` returns true or false values, and how this can be used by the main program that calls the function.

[3]

END OF PAPER